

TOMBSTONE MUNICIPAL AIRPORT

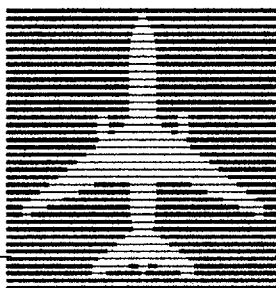
--- TOMBSTONE, ARIZONA ---



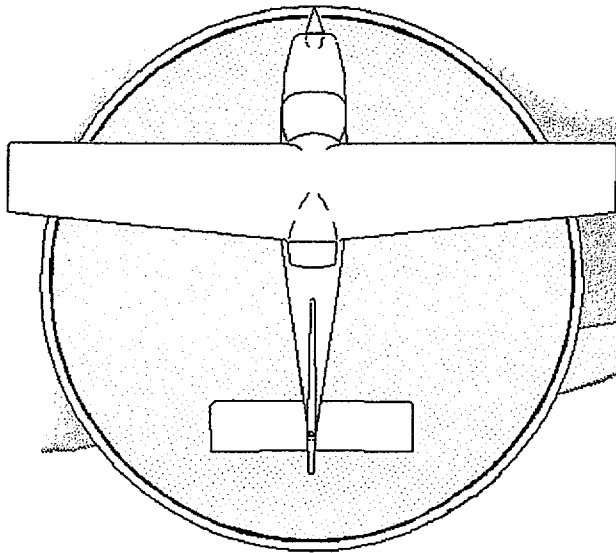
AIRPORT MASTER PLAN 1999

FINAL REPORT

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TOMBSTONE MUNICIPAL AIRPORT

Tombstone, Arizona

AIRPORT MASTER PLAN - 1999 2. AVIATION DEMAND FORECASTS

INTRODUCTION

Forecasts of aviation activity serve as a guideline for the timing required for implementation of airport improvement programs. While such information is essential to successful comprehensive airport planning, it is very important to recognize that forecasts are only approximations of future activity, based upon historical data and from the standpoint of present situations. They therefore must be used with careful consideration, as they may lose their validity through the passage of time. For this reason, an ongoing program of examination of local airport needs, as well as national and regional trends, is recommended and encouraged in order to promote the orderly development of the Tombstone Municipal Airport.

Air Traffic Control personnel maintain records of aircraft operations at towered airports. At airports which are not served by air traffic control towers, estimates of existing aviation activity are necessary in order to form a basis for the development of realistic forecast projections. These estimates are usually based upon a review of available historical data, as well as observations of activity, and contacts with airport users.

Following the development of the estimated current demand, projections are made based upon established growth rates, area demographics, industry trends and other important indicators. Forecasts are prepared for the Initial Term (five-year), the Intermediate Term (ten-year) and the Ultimate Term (fifteen and twenty-year) time frames. Having forecasts within these time frames will allow the construction of airport improvements to be timed to meet demand, but not so early as to remain idle for an unreasonable length of time.



Wyatt Earp (c1885)

Types of Operations

There are four general types of aircraft operations which are considered in the planning process. These are termed local, based, itinerant, and transient. They are defined as follows:

- **Local operations** are defined as aircraft movements (departures or arrivals) for the purpose of training, pilot currency or pleasure flying, within the immediate area of the local airport. These operations typically consist of touch-and-go operations, practice instrument approaches, flights to and within local practice areas, and pleasure flights which originate and terminate at the airport under study.
- **Itinerant operations** are defined as arrivals and departures other than local operations, as described above. This type of operation is closely tied to local demographic indicators, such as local industry and business use of aircraft and usage of the facility for recreational purposes.
- **Based aircraft operations** are defined as the total operations made by aircraft based at the airport under study, with no attempt to classify the operations as to purpose.
- **Transient operations** are defined as the total operations made by aircraft other than those based at the airport under study. These operations typically consist of business or pleasure flights originating at other airports, with termination or a stopover at the study airport.

The forecasts for Tombstone Municipal Airport will be confined to definition of Based and Transient operations.

REVIEW OF OTHER
APPLICABLE
PLANNING
DOCUMENTS

Over the past several years there have been many planning studies conducted that either directly or indirectly affect the airports within Arizona, Cochise County and the Tombstone Municipal Airport. These include the following:

- the 1982 Cochise County Airport System Plan (Willdan Associates - July, 1982);
- the 1994 Cochise County Airport System Plan update (WLB Group, Inc. - March, 1994);
- the 1995 Arizona State Aviation Needs Study (Bucher, Willis & Ratliff - November, 1995);
- the 1997 Cochise County Airport Master Plan (Bucher, Willis & Ratliff - December, 1997);

- the 1997 Bisbee-Douglas International Airport Comprehensive Master Plan (Nicholas J. Pela & Associates/Gannett Fleming, Inc. - June, 1997); and
- the FAA Terminal Area Forecasts or TAF (updated March, 1998).

Of these documents, the 1995 Arizona State Aviation Needs Study (SANS), and the 1982 and 1994 Cochise County Airport System Plans (RASP) directly address the Tombstone airport, providing inventory and forecast information regarding airport activity and based aircraft. The master plans for the Cochise County and Bisbee-Douglas International airports provide planning information for these two nearby facilities that may indirectly affect development and activity at the Tombstone airport.

The Cochise County
Airport System Plans
(RASP)

Although the 1982 Cochise County Airport System Plan was superseded by the 1994 Cochise County Airport System Plan, it contains important historical information regarding the past activity at the Tombstone airport. Both of these plans are Regional Airport System Plans, or "RASP's". The 1982 Plan will be referred to as the "1982 RASP". The 1994 Plan will be referred to as the "1994 RASP".

The 1982
Cochise
County Airport
System Plan

The 1982 RASP indicates that, in 1981, there were 7 aircraft registered to owners who resided in the city of Tombstone. Of these 7 aircraft, only 2 were based at the Tombstone Municipal Airport. The others were based at the Cochise County Airport in Willcox.

The 1982 RASP included short term automated traffic activity observations at all Cochise County airports, including Tombstone. It was estimated that 186,502 operations occurred at the county's airports in 1981. About 2,361 annual operations, about 1.26% of total county activity, were estimated to have occurred at Tombstone Municipal Airport.

The 1982 RASP also indicates that there were 176 aircraft registered to Cochise County residents in 1981. About 4% of these ($7 \div 176$) were owned by residents of Tombstone.

The 1994
Cochise
County Airport
System Plan

The 1994 RASP indicates that, in 1992, there were 5 aircraft registered to owners who resided in the Tombstone Airport's service area. Of these 5 aircraft, only 1 was based at the Tombstone Municipal Airport. It was estimated that 117,430 operations occurred at the county's airports in 1992. Only 300 annual operations, about 0.26% of total county activity, were estimated to have occurred at Tombstone.

The 1994 RASP indicates that there were 160 aircraft registered to Cochise County residents in 1992. About 3% of these ($5 \div 160$) were owned by residents of the Tombstone service area.

The 1994 RASP estimated an increase in the number of based aircraft at all county airports to increase at the rate of about 2.95% per year between 1992 and 2012. Based aircraft at Tombstone's airport are projected to remain at 1 until 2007, then to increase to 2 through 2012. This represents an increase of about 3.5% per year (however, there are currently no aircraft based at Tombstone).

The annual operations forecasts contained in the 1994 RASP indicate an increase of about 2.81% per year for all airports in the county over the 1992-2012 planning period. Annual operations at Tombstone were estimated to increase from 300 in 1992 to 400 in 2012, an increase of about 1.45% per year.

The 1995 Arizona State Aviation Needs Study (SANS)

The 1995 Arizona State Aviation Needs Study (SANS) includes information on the Tombstone Municipal Airport, including inventories of based aircraft, estimates of current aeronautical activity, and forecasts of future activity.

The SANS indicates that there were 2 aircraft based at Tombstone in 1995, and projects that this will remain constant throughout the 1995-2015 planning period. The number of Cochise County based aircraft were estimated at 130 in 1995 and forecast to increase to 169 by the year 2015, an average increase of about 1.33% per year. In the projections, Tombstone's share of county aircraft varies from about 1.5% to 1.2%.

The SANS estimated only 216 total annual operations at Tombstone in 1995, and projected that this will remain constant through the 1995-2015 planning period. Annual operations at all Cochise County airports were forecast to increase at an annual rate of 0.69% through the planning period, from 106,060 to 121,523 operations.

An inventory and forecasts of licensed pilots residing in Arizona and in Cochise County is also included in the SANS. The table below contains a summary of the SANS information. The total numbers of pilots presented includes private, commercial and air transport pilots. As is evidenced in the table, the SANS suggests that aeronautical activity in the county will not keep pace with the rest of the state.

HISTORIC AND FORECAST LICENSED PILOTS
ARIZONA AND COCHISE COUNTY

Year	Arizona Licensed Pilots	Cochise Licensed Pilots	County Share of Licensed Pilots
1980	12,180	349	2.87%
1990	11,672	260	2.23%
1995	13,072	279	2.13%
2000	14,921	303	2.03%
2005	16,803	326	1.94%
2010	18,734	348	1.86%
2015	20,732	368	1.78%
Trend	+1.54%	+0.16%	-1.36%
(%/year)			

*Source: 1995 Arizona State Aviation Needs Study (SANS)
(calculations by N.J. Pela & Associates)*

Master Plans for
Other Cochise
County Airports

The recently completed master plans for the Cochise County (Willcox) Airport and the Bisbee-Douglas International Airport (BDI) project a relatively strong rate of growth for the area in terms of aeronautical activity. The projections for based aircraft and total annual operations by general aviation aircraft included in these documents are presented on the following page.

The forecast activity for the Cochise County Airport was based upon a continuation of the historic trend in the growth of aeronautical activity in the Willcox area.

The estimated number of operations at the Bisbee-Douglas airport for 1997 was based on the *potential level of activity* at the airfield, predicated upon major improvements being made. Currently, activity at the airfield is severely dampened as a result of the condition of runway pavements and other infrastructure. The estimated actual level of activity in 1997 was estimated to be only 3,285 annual operations. The major runway improvements at Bisbee-Douglas that were recommended in the master plan were in the initial stages of development at the time of preparation of this report.

The Bisbee-Douglas airport's master plan indicates that two single engine aircraft that are based at BDI are owned by individuals who reside in Tombstone.

FORECAST AERONAUTICAL ACTIVITY
Cochise County Airport & Bisbee-Douglas International Airport

<u>Based Aircraft:</u>	<u>1997</u>	<u>2002</u>	<u>2007</u>	<u>2012</u>	<u>2017</u>
Cochise County Airport	24	24	25	28	34
Trend (%/year)					+1.76%
Bisbee-Douglas Int'l Airport	24	34	44	53	63
Trend (%/year)					+4.95%

<u>Annual Operations:</u>	<u>1997</u>	<u>2002</u>	<u>2007</u>	<u>2012</u>	<u>2017</u>
Cochise County Airport	7,000	7,000	7,250	9,060	9,680
Trend (%/year)					+1.64%
Bisbee-Douglas Int'l Airport	25,650	30,770	35,878	40,467	45,556
Trend (%/year)					+2.92%

Sources:

*Cochise County Airport Master Plan (Bucher, Willis & Ratliff - December, 1997)
Bisbee-Douglas International Airport Comprehensive Master Plan (N.J. Pela &
Associates/Gannett Fleming, Inc. - June, 1997).*

FAA Terminal Area
Forecasts

The FAA Terminal Area Forecasts (TAF) includes operational data for 873 U.S. airports, mainly those with operating control towers. While the current TAF does not include data for the Tombstone airport, it does include data regarding aviation activity within Arizona.

The TAF indicates that air carrier passenger enplanements in Arizona increased from 12.5 million in 1992 to 16.9 million in 1996, a 7.8% increase over five years.

The TAF forecasts that enplanements will continue to grow at the rate of about 4.5% per year through the year 2010.

Total commercial operations within Arizona increased from 698,412 in 1992 to 813,815 in 1996, a 3.9% increase over the five-year period. The TAF predicts that commercial operations will continue to increase at the rate of about 2.65% per year through 2010.

The TAF indicates that total aircraft operations within Arizona were steady at about 3.7 million between 1992 and 1996, and predicts that total operations will increase at the rate of about 1.38% per year through the year 2010.

This moderate growth and apparent health in the Arizona aviation economy will affect the future demands placed upon the Tombstone Municipal Airport.

COCHISE COUNTY DEMOGRAPHICS

As part of the data collection and research for this master planning project, records of Cochise County and City of Tombstone demographics were collected. These are listed for reference in the Summary of Historical Data on the following page.

Record data for population, per capita income, total employed persons, numbers of registered aircraft, and the number of full and part time jobs in Cochise County were collected from various sources. The sources of the data are referenced in the summary tabulation.

From 1970 through 1983, the number of registered aircraft in Cochise County increased at an average rate of +9.5% annually. However, from 1983 until 1994, the number of registered aircraft has declined at an average rate of about -4.3% per year. This is possibly a reflection of the national aviation industry trends discussed above.

During the 1970-1983 period, County population increased at an average rate of +2.72% per year. This trend continued at the rate of about +1.70% per year through 1996.

County per capita income increased at an average annual rate of +7.55% from 1970 to 1983, then at an average rate of +4.70% per year through 1996.

The number of employed persons in Cochise County increased at an average annual rate of +2.6% from 1970 to 1983, then at an average rate of +5.4% through 1994.

Summary of Historical Data
Cochise County and Tombstone Municipal Airport

YEAR	County Population ¹	County Per Capita Income ¹	Number of Employed Persons in County ⁷	City of Tombstone Population ⁷	County Registered Aircraft ³	Tomb- stone Based Aircraft ⁵	Tomb- stone Share of County Aircraft
1970	62,770	\$3,453	15,300		65		
1971	67,149	\$3,785	19,050		85		
1972	70,938	\$4,005	20,325		97		
1973	74,558	\$4,293	21,175		74		
1974	76,165	\$4,574	18,700		119		
1975	76,922	\$4,763	17,900		120		
1976	78,946	\$5,128	18,300		139		
1977	80,688	\$5,405	18,900		145		
1978	83,160	\$6,018	20,700		157		
1979	86,268	\$6,283	20,900		160		
1980	85,686 ⁷	\$7,177	21,400	1,632	183		
1981	88,036	\$7,848	21,400		199	7 ⁶	3.5%
1982	88,373	\$8,251	21,100		208		
1983	88,872	\$8,888	21,200		211		
1984	90,937	\$9,508	22,000		202		
1985	91,192	\$10,109	23,700		206		
1986	94,093	\$10,468	24,800		179		
1987	96,690	\$10,938	31,150		200		
1988	96,316	\$11,602	31,800		199		
1989	97,551	\$12,042	33,410		194		
1990	97,624 ⁷	\$12,888	26,738	1,220	181		
1991	98,626	\$13,580			174 ⁴		
1992	100,661	\$14,378			129 ⁴	5 ²	3.9%
1993	103,215	\$14,705			131 ⁴		
1994	107,693	\$14,777	37,680		130 ⁴		
1995	110,414	\$15,311			130 ⁴		
1996	114,925 ⁷	\$16,136		1,435	(130)		

¹ Source: U.S. Department of Commerce - Bureau of Economic Analysis (unless noted otherwise).

⁶ Source: Cochise County Airport System Plan, 1982 inventory (actual - registered).

² Source: Cochise County Airport System Plan, 1994 inventory (actual - registered).

⁷ Source: Arizona Department of Economic Security - 1997 (unless noted otherwise).

³ Source: FAA Census of Civil Aircraft, 1970-1989 (unless otherwise noted).

⁸ Source: FAA Form 5010 (1995)

⁴ Source: Arizona DOT/ Aeronautics Division Records (registered).

() Indicates approximate data.

⁵ Indicates aircraft registered to owners with Tombstone addresses, not aircraft at the airport.

CURRENT ACTIVITY
AT TOMBSTONE
MUNICIPAL AIRPORT

Although there are currently no aircraft based (regularly parked) at Tombstone Municipal Airport, there are five aircraft registered to owners with City of Tombstone addresses. These aircraft are kept at other Cochise County airports, and will probably remain as such until significant improvements in the areas of security and available services are made at Tombstone.

The aircraft registered to Tombstone residents represent about 3.9% of the total number of aircraft in Cochise County. The population of Tombstone (1,435 people) represents about 1.3% of the population of Cochise County (using 1996 data).

The 1995 Arizona State Aviation Needs Study (SANS) indicates that there were about 216 total annual operations at Tombstone in 1995. The 1994 Cochise County Airport System Plan (RASP) estimated about 300 total annual operations. For the purposes of this study, it is assumed that these estimates are a fairly accurate indication of the present low level of utilization of the Tombstone airport.

The SANS estimated that there were 106,060 total annual general aviation operations at Cochise County Airports in 1995. In comparison, the RASP estimated about 117,430 total general aviation operations in the county in 1992.

INTRODUCTION:
FORECASTS OF
FUTURE AVIATION
ACTIVITY

In preparing the aviation demand forecasts for Tombstone, it was assumed that the current condition of the airport's infrastructure is a major factor in the present low utilization of the airport. With an initial program of improvements to the airport's security features, services, and pilot amenities, an immediate increase in activity will occur. This increase will first be evidenced by the local aircraft owners basing their existing aircraft at Tombstone instead of at other airports. An increase in activity by transient users will follow with aggressive marketing of the airport as a viable tourist and business user destination.

The forecasts that follow assume no change in the level of activity at Tombstone until initial improvements are made. The year 2000 has been assumed as a reasonable threshold date for completion of these improvements.

Average Operations
per Based Aircraft:
Multiple Airport User
Surveys

In the process of preparing numerous airport master plans for U.S. general aviation airports, an extensive database of information regarding aircraft operations has been accumulated. Over the past ten years, airport user survey questionnaires have been distributed to aircraft owners who base their aircraft at 21 different airports. These questionnaires made inquiry as to the number of total operations performed by each aircraft and give a good indication of the probable level of use of private general aviation aircraft at Tombstone after

improvements are made.

In the surveys, it was found that airports with a very high level of training operations, such as Buffalo, Minnesota and Rexburg, Idaho, have the highest use per based aircraft. The same is true of airports in communities with heavily tourism-based economies, such as Brainerd and Cloquet, Minnesota.

Of the Cochise County airports included in the surveys, The Bisbee-Douglas International Airport's aircraft owners responded with the lowest use of their aircraft (30). In contrast, the Douglas Municipal Airport's based aircraft owners indicated 138 average annual operations per based aircraft.

The results of the surveys, in terms of total annual operations by based aircraft, are summarized below.

Airport User Surveys 1988-1996
SUMMARY OF BASED AIRCRAFT OPERATIONS

AIRPORT	YEAR	Annual Operations
Sawyer County Airport (WI)	1988	208
Buffalo Municipal Airport (MN)	1989	481
Mora Municipal Airport (MN)	1989	232
Two Harbors Municipal Airport (MN)	1989	275
Rusk County Airport (WI)	1989	97
Chippewa Valley Regional Airport (WI)	1990	217
Cumberland Municipal Airport (WI)	1990	220
Canby Municipal Airport (MN)	1991	118
Glencoe Municipal Airport (MN)	1991	119
Portage Municipal Airport (WI)	1992	360
Rush City Municipal Airport (MN)	1992	116
Thief River Falls Regional Airport (MN)	1992	194
Brainerd-Crow Wing County Regional (MN)	1990	566
Cambridge Municipal Airport (MN)	1993	115
Cloquet Municipal Airport (MN)	1993	410
Red Wing Municipal Airport (MN)	1994	128
Rexburg - Madison County Airport (ID)	1994	427
Pershing County - Derby Field (NV)	1993	205
Douglas Municipal Airport (AZ)	1994	138
Baudette International Airport (MN)	1994	64
Bisbee-Douglas International Airport (AZ)	1996	30
Average Annual Operations by Each Based Aircraft:		225

ALTERNATE
FORECASTS OF
AVIATION ACTIVITY

Because the Tombstone airport is an "emergent" facility at the present time, with very little activity, it is not possible to base estimates of future activity on any historic trend of past activity at the airport. For this reason several alternate projections have been made, each based on a different methodology and a different set of growth indicators. The result of this approach is a range of confidence for the future level of activity at the airport, rather than a single line basis for improvement recommendations.

The alternate forecasts are as follows:

Market-Share
Analysis Model

The methodology developed for this alternate forecast scenario involves the use of Cochise County population data from the Arizona Department of Economic Security (DES) as compared to records of the number of based aircraft in the county from ADOT/Aeronautics Division records for 1996.

A figure for anticipated based aircraft was arrived at by applying the following Aircraft-to-Population Index equation:

Aircraft-to-Population Index for Cochise County

- A_c = Registered Aircraft in Cochise County
 P_c = Cochise County Population
 I_c = Number of Aircraft Per Person in Cochise County

$$I_c = A_c \div P_c$$

$$I_c = 130 \div 114,925 = 0.001131$$

The number of potential based aircraft in Cochise County for the 2000-2020 planning period was estimated by applying this Aircraft-to-Population Index for Cochise County to the projected county population from the Arizona Department of Economic Security (DES). The number of based aircraft at Tombstone Municipal Airport was estimated by assuming that 4% of Cochise County's aircraft will be based at Tombstone (3.5% and 3.9% of the county's aircraft were registered to Tombstone residents in 1981 and 1992, respectively).

The number of total operations at the Tombstone airport was estimated by assuming that total operations per based aircraft throughout the county will be distributed equally among the county's public use airports. Therefore, total

Section 2: Aviation Demand Forecasts

annual operations for Tombstone will be equal to 4% of the total SANS forecast county operations.

Annual Based operations were estimated by applying the average annual operations for based aircraft as derived from the multiple aircraft owner surveys (225 annual operations per based aircraft). Transient operations are equal to the total annual operations minus annual Local operations.

The forecast total general aviation operations for Cochise County as contained in the 1995 SANS were used as the basis of the estimates. Since the SANS projections only extend through 2015, values for 2020 have been extrapolated.

The results of the Market-Share Analysis Model are presented on the following page.

Market-Share Analysis Model
Forecast Aviation Activity in Cochise County
and
Tombstone Municipal Airport

	1998	2000	2005	2010	2015	2020
Cochise County Population (Az DES)	118,492	121,837	129,580	137,035	143,793	149,990
SANS Forecast of County GA Operations	<u>108,271</u>	110,033	112,853	117,862	121,523	<u>125,774</u>
SANS Forecast of County Based Aircraft	135	141	150	161	169	<u>181</u>
Adjusted Forecast of County Based Aircraft	130 (actual)	138	147	155	163	170
Tombstone Municipal Airport Forecasts Market-Share Analysis Model						
Forecast Based Aircraft	0	5	6	6	7	7
Annual Based Operations	0	1,125	1,350	1,350	1,575	1,575
Annual Transient Operations	200	3,276	3,164	3,364	3,286	3,456
Total Annual Operations	200	4,401	4,514	4,714	4,861	5,031

Economic Trend
Model

The selected methodology for the Economic Trend Model, ADM v7.02 (Airport Demand Model), considers the relationship between aviation activity, population and a selected economic indicator. The assumption is made that, with a constant economy, general aviation activity will vary directly with population. In theory, when the economy improves a larger percentage of income is available to be used for acquisition of aircraft and for aviation-related activities.

The figure which represents the difference between economic growth and corresponding demand in a particular industry is called the elasticity index. Theoretically, if an airport is realizing its potential in terms of utilization by its service area, a computed elasticity index will approximate the national average.

The ADM program analyzes historic data for a selected period and computes average growth indices for population and the economic indicator, and a representative elasticity index. The number of based aircraft is then multiplied by the growth indices and the elasticity index for each successive year.

The 1990-1995 period was selected as the historic data sample period for this scenario.

The most significant indicator for future aviation activity at Tombstone is the growth in number of licensed pilots in Cochise County during the sample period, which increased from 260 in 1990 to 279 in 1995. This represents an increase of about +1.43% per year.

The selected economic indicator was per capita income in Cochise County, which increased from \$12,888 in 1990 to \$15,311 in 1995. This is an increase of about +3.51% per year during the 5-year sample period.

Cochise County population increased at the rate of about +3.32% per year, from 97,624 in 1990 to 114,925 in 1995. It should be noted that the ADM computer model generates an independent projection of population based on the sample data. In this case, the projected growth is much more aggressive than the Arizona Department of Economic Security forecasts.

A Demand Elasticity Index of 0.3943 was computed using these indicators.

In conformance with the Market-Share Analysis Model, the forecasts begin at the year 2000, assuming that 5 aircraft owned by Tombstone residents will be based at the Tombstone airport after initial improvements are made. The number of total operations at Tombstone in the year 2000 was estimated by assuming that total operations per based aircraft throughout the county will be distributed equally among the county's public use airports. Therefore, total annual operations for Tombstone in 2000 will be equal to 4% of the total SANS

Section 2: Aviation Demand Forecasts

forecast county operations. This is also in conformance with the Market-Share Analysis Model scenario.

Annual Based operations were estimated by applying the average annual operations for based aircraft as derived from the multiple aircraft owner surveys (225 annual operations per based aircraft). Transient operations are equal to the total annual operations minus annual Local operations.

Again, to maintain conformance with the Market-Share Analysis Model, the forecast total general aviation operations for Cochise County as contained in the 1995 SANS were used as the basis of the estimates. Since the SANS projections only extend through 2015, values for 2020 have been extrapolated.

The results of the Economic Trend Model are presented on the following page.

Economic Trend Model
Forecast Aviation Activity in Cochise County
and
Tombstone Municipal Airport

	1998	2000	2005	2010	2015	2020
Cochise County Population (Az DES)	118,492	121,837	129,580	137,035	143,793	149,990
Cochise County Population (ADM)		121,837	143,450	168,897	198,859	234,135
SANS Forecast of County GA Operations	<u>108,271</u>	110,033	112,853	117,862	121,523	<u>125,774</u>
Adjusted Forecast of County Based Aircraft	130 (actual)	138	147	155	163	170
Tombstone Municipal Airport Forecasts Economic Trend Model (ADM v7.02)						
Forecast Based Aircraft	0	5	5	6	6	7
Annual Based Operations	0	1,125	1,205	1,291	1,383	1,481
Annual Transient Operations	200	3,276	3,509	3,758	4,026	4,313
Total Annual Operations	200	4,401	4,714	5,049	5,409	5,794

Comparison of
Forecast Model
Results

The major difference between the two forecast models is that the Economic Trend Model predicts a slightly greater number of operations at Tombstone during the study period. This model predicts an "unconstrained" (and very aggressive) growth in population, area aviation activity, and per capita income based solely upon the growth rates seen in the selected sample period (1990-1995). The Market-Share Analysis Model based its results on a more "constrained" growth in county population, as provided by the Arizona Department of Economic Security.

The numbers of based aircraft projected in the two models are very similar, and the number of operations predicted in both models are both quite reasonable. The range of activity indicated by the two models may be regarded as a reasonable depiction of the probable activity level at Tombstone Airport after initial improvements have been made.

The graphs in Figure 2A, at the end of this section, are a comparison of the Market-Share Analysis Model and the Economic Trend Model, as well as the SANS and RASP forecasts for Tombstone.

Figure 2B, also at the end of the section, is a tabulation comparing all available forecasts from prior planning studies and this study.

CRITICAL AIRCRAFT

The "critical", or "design", aircraft for any given airport facility is defined as that aircraft (or group of aircraft) whose dimensional and/or performance characteristics are the basis for selection of facilities design criteria. The critical aircraft must be demonstrated to account for a minimum of 500 annual actual or forecast operations.

Different aircraft may govern the requirements for runway design, and for lateral and vertical separation standards. The factors usually considered are the aircraft maximum gross takeoff weight, approach speed category, wingspan, and tail height.

The critical aircraft currently using the Tombstone Municipal Airport facilities is limited to a mix of very light ARC A-I piston singles and twins, which account for a total of about 200 annual operations.

The forecasts presented above are predicated upon initial improvements being made to the airport which would promote an increase in activity. The majority of this activity will most probably remain as light piston types. However, use by larger piston singles and twins in the future, or even some smaller business turboprops and jets, should not be ruled out. Because of the emergent character of the Tombstone airport, its ultimate role will be at least partially determined

by the decisions made by the City regarding the extent of airport improvements. In this study, no attempt was made to predict the mix of larger aircraft that may use the Tombstone airport. In the following sections, alternatives will be presented that will provide development options designed to accommodate different levels of "critical" use by larger and faster aircraft types.

A representative "design fleet" of ARC A-I, B-I and B-II aircraft is presented in the tables on the following pages. The tables are output files from the AcData v6.10 aircraft database, which provides aircraft dimensional and approximate performance criteria for 465 aircraft types and configurations. Runway requirements for the various aircraft were computed based on a density altitude of 8,000', which was derived by using a pressure altitude of 4,750' MSL at 95° Fahrenheit.

In each of the tabulations, critical design elements are indicated by **Bold** type.

Page 2-19 is a tabulation of ARC A-I, B-I and B-II aircraft that could be accommodated by the present runway configuration and length (4,600'), assuming that the runway is strengthened (paved) and that adequate turnarounds, taxiways, parking and access improvements are made. With these improvements, the present runway could be used by aircraft as large as the Metro II and III commuter airline turboprops, the Beechcraft Kingair B200, and the Cessna Citation I/SP single-pilot business jet.

Page 2-20 lists a mix of aircraft through ARC B-II that could be accommodated at Tombstone if additional runway length were to be made available in the future. These critical aircraft listings indicate that a 6,100' long runway would accommodate all of the selected database aircraft at the 8,000' density altitude. Most of the listed types could be accommodated by a 5,500' runway.

Section 2: Aviation Demand Forecasts

Tombstone Municipal Airport Critical Aircraft Design Fleet Existing Runway Length (4,600')

PARAMETERS :

DENSITY ALTITUDE : 8000 MSL

GENERAL TYPE CODE : General (Piston Singles & Twins, Jets)

U.S CUSTOMARY UNITS : Speed in knots.....Lengths in Feet.....Weight in Pounds

Model-----AppSpeed--WingSpan--AClength--TailHite--TOWeight---RWindex

ARC A-I

Beechcraft 65 Queen Air	90	45.88	33.33	14.17	7700	4220
Cessna 177B	60	35.50	27.25	8.58	2500	2840
Cessna 182Q	64	36.00	28.00	9.20	2950	2740

ARC B-I

Metro III	112	46.20	59.40	16.70	12500	4500
Metro II SA226-TC	112	46.25	59.42	16.67	10500	3050
Cessna 340A	92	38.10	34.30	12.60	5000	3042
Cessna 402C	95	44.12	36.38	11.45	5500	3052
Cessna 414A	94	44.10	36.40	11.50	5700	3856
Cessna 421C	96	41.10	36.40	11.50	6200	3189
Cessna Citation I/SP	107	47.10	43.50	14.33	11850	4390

ARC B-II

Beechcraft B200	98	54.50	43.80	15.00	12500	4500
Merlin IVC	113	57.00	59.33	16.67	12500	4500
Cessna 441	99	49.30	34.70	12.80	7800	4447

Source: AcData v6.10 computer database of 465 aircraft

Section 2: Aviation Demand Forecasts

Tombstone Municipal Airport Critical Aircraft Design Fleet Assuming Additional Future Runway Length

P A R A M E T E R S :

DENSITY ALTITUDE : 8000 MSL

GENERAL TYPE CODE : General (Piston Singles & Twins, Jets)

U.S CUSTOMARY UNITS : Speed in knots.....Lengths in Feet.....Weight in Pounds

Model-----AppSpeed--WingSpan--AClength--TailHite--TOWeight---RWindex

ARC A-I through ARC B-II

Beechcraft 65 Queen Air	90	45.88	33.33	14.17	7700	4220
Beechcraft B200	98	54.50	43.80	15.00	12500	4500
Beechcraft E-18S	87	49.20	35.10	10.50	9300	5290
Beechcraft B100	111	45.90	39.90	15.40	11500	5400
Cessna 177B	60	35.50	27.25	8.58	2500	2840
Cessna 182Q	64	36.00	28.00	9.20	2950	2740
Cessna 310R	93	36.92	31.96	10.67	5500	6034
Merlin IVC	113	57.00	59.33	16.67	12500	4500
Metro III	112	46.20	59.40	16.70	12500	4500
Metro II SA226-TC	112	46.25	59.42	16.67	12500	4650
Cessna 425	103	44.10	35.90	12.60	8600	5265
Cessna 425	103	44.10	35.90	12.60	8200	5115
Cessna 441	99	49.30	34.70	12.80	9850	5084
Cessna 340A	92	38.10	34.30	12.60	5990	4621
Cessna 402C	95	44.12	36.38	11.45	6850	5028
Cessna 414A	94	44.10	36.40	11.50	6750	5693
Cessna 421C	96	41.10	36.40	11.50	7450	4877
Cessna Citation I/SP	107	47.10	43.50	14.33	11850	4390

Source: AcData v6.10 computer database of 465 aircraft

AIRPORT SEASONAL USE

Some level of seasonal fluctuation in aircraft operations may be expected at any airport. This fluctuation is most apparent in regions with severe winter weather patterns, at nontowered general aviation airfields. The fluctuation is less pronounced at major airports, with a high percentage of commercial and scheduled airline activity, and also at those facilities with a milder winter climate and/or a high percentage of training activity.

The southeastern Arizona climate provides a very stable environment for aviation activity. The winter weather is mild and although daytime summer temperatures are typically in the 90's and 100's, the morning and evening hours are usually quite comfortable.

According to weather observers at the Bisbee-Douglas International Airport, instrument conditions in the Cochise County area occur less than 3% of the time. Although the present level of activity at Tombstone is light and appears to be quite sporadic, the potential is that a fairly even distribution of seasonal demand will be experienced after improvements are made.

The probable future seasonal use at Tombstone was modeled by applying the forecast total annual operations to the average seasonal use trend from the 1979-84 FAA records of aircraft operations handled by tower facilities nationally (from the FAA Statistical Handbook of Aviation). This typical seasonal use curve is presented below. For the purposes of comparison, a seasonal use curve which has been developed for non-towered airports with severe winter weather is also presented.

TYPICAL SEASONAL USE TREND CURVES

<u>MONTH</u>	<u>Nontowered w/Severe Winter Weather</u>	<u>FAA Towered Airports</u>
January	3.5%	7.2%
February	4.0%	8.2%
March	4.8%	8.6%
April	7.5%	9.0%
May	11.3%	9.1%
June	13.5%	9.4%
July	14.8%	9.1%
August	13.0%	8.7%
September	10.0%	8.7%
October	8.0%	7.8%
November	5.8%	7.1%
December	3.8%	7.1%

PEAK DEMAND
CALCULATIONS

In order to arrive at a reasonable estimate of the actual peak demand upon the airport facilities, it was necessary to develop a method to calculate the estimated Maximum Peak Hourly Demand which might be expected to occur during the hours of peak usage of the airport. The Seasonal Use Trend Curve, as presented above, was used as a tool to determine this usage.

Using the Seasonal Use information, a formula was derived which will calculate the average daily operations in a given month, based on the percentage of the total annual operations for that month, as determined by the curve.

The formula is as follows:

Where T = Monthly percent of use (from curve).
 M = Average monthly operations.
 A = Total annual operations.
 D = Average Daily Operations in a given month.
 M = $A (T / 100)$
 D = $M / (365 / 12)$

Experience has shown that approximately 90% of total daily operations will occur between the hours of 7:00 AM and 7:00 PM (12 hours) at a typical General Aviation airport, and that the maximum peak hourly occurrence may be 50% greater than the average of the hourly operations calculated for this time period.

Therefore, the *Estimated Peak Hourly Demand* (P) in a given month was determined by compressing 90% of the Average Daily Operations (D) in a given month into the 12 hour peak use period, reducing that number to an hourly average for the peak use period, and increasing the result by 50%, as follows:

Where D = Average Daily Operations in a given month.
 P = Peak Hourly Demand in a given month.
 P = $1.5 (0.90D / 12)$

Both the Market-Share Analysis and Economic Trend projections have been modeled to provide a range of potential future demand.

The results are as follows:

Section 2: Aviation Demand Forecasts

Estimated Hourly Demand / Month Estimated Potential Activity - 2000

Planning Year:	2000
Operations:	4,401

Month	% USE	Monthly	Daily	Hourly
January	7.20	317	10	1
February	8.20	361	12	1
March	8.60	378	12	1
April	9.00	396	13	1
May	9.10	400	13	1
June	9.40	414	14	2
July	9.10	400	13	1
August	8.70	383	13	1
September	8.70	383	13	1
October	7.80	343	11	1
November	7.10	312	10	1
December	7.10	312	10	1

Estimated Hourly Demand / Month
Estimated Potential Activity - 2020
Market-Share Analysis Model

Planning Year:	2020
Operations:	5,031

Month	% USE	Monthly	Daily	Hourly
January	7.20	362	12	1
February	8.20	413	14	2
March	8.60	433	14	2
April	9.00	453	15	2
May	9.10	458	15	2
June	9.40	473	16	2
July	9.10	458	15	2
August	8.70	438	14	2
September	8.70	438	14	2
October	7.80	392	13	1
November	7.10	357	12	1
December	7.10	357	12	1

Estimated Hourly Demand / Month
Estimated Potential Activity - 2020
Economic Trend Model

Planning Year:	2020
Operations:	5,794

Month	% USE	Monthly	Daily	Hourly
January	7.20	417	14	2
February	8.20	475	16	2
March	8.60	498	16	2
April	9.00	521	17	2
May	9.10	527	17	2
June	9.40	545	18	2
July	9.10	527	17	2
August	8.70	504	17	2
September	8.70	504	17	2
October	7.80	452	15	2
November	7.10	411	14	2
December	7.10	411	14	2

As is evident in the tables above, the maximum peak demand will remain quite low, occurring in June, with a potential for 2 operations per hour and a potential range of 14 to 18 peak operations per day.

AIRPORT DEMAND
VERSUS CAPACITY

The methodology for computing the relationship between an airport's configuration and its theoretical capacity is contained in FAA Advisory Circular AC 150/5060-5, Airport Capacity and Delay. The FAA's Airport Design program includes a routine for estimating capacity of small airports that is based on this methodology.

The Annual Service Volume, or ASV, is a calculated reasonable estimate of an airport's total annual capacity, taking into account differences in runway utilization, weather conditions and aircraft mix that might be encountered in a year's time. When compared to the existing or forecast operations of an airport, the ASV will give an indication of the adequacy of the facility in relationship to its activity level.

The ASV for Tombstone Municipal Airport, in both its present single-runway configuration and a possible two-runway crossing configuration, is 230,000 annual operations. The forecasts developed in this study indicate that total annual activity will not exceed 6,000 operations, or about 2.6% of the airport's ASV.

Tombstone's capacity in terms of operations per hour is estimated as 98 operations per hour in Visual Flight Rules (VFR) conditions, and 59 operations per hour in Instrument Flight Rules (IFR) conditions. The hourly demand estimates developed in this study indicate that hourly activity will not exceed 2 operations during the twenty year planning period.

There are no capacity constraints apparent for the Tombstone airport.

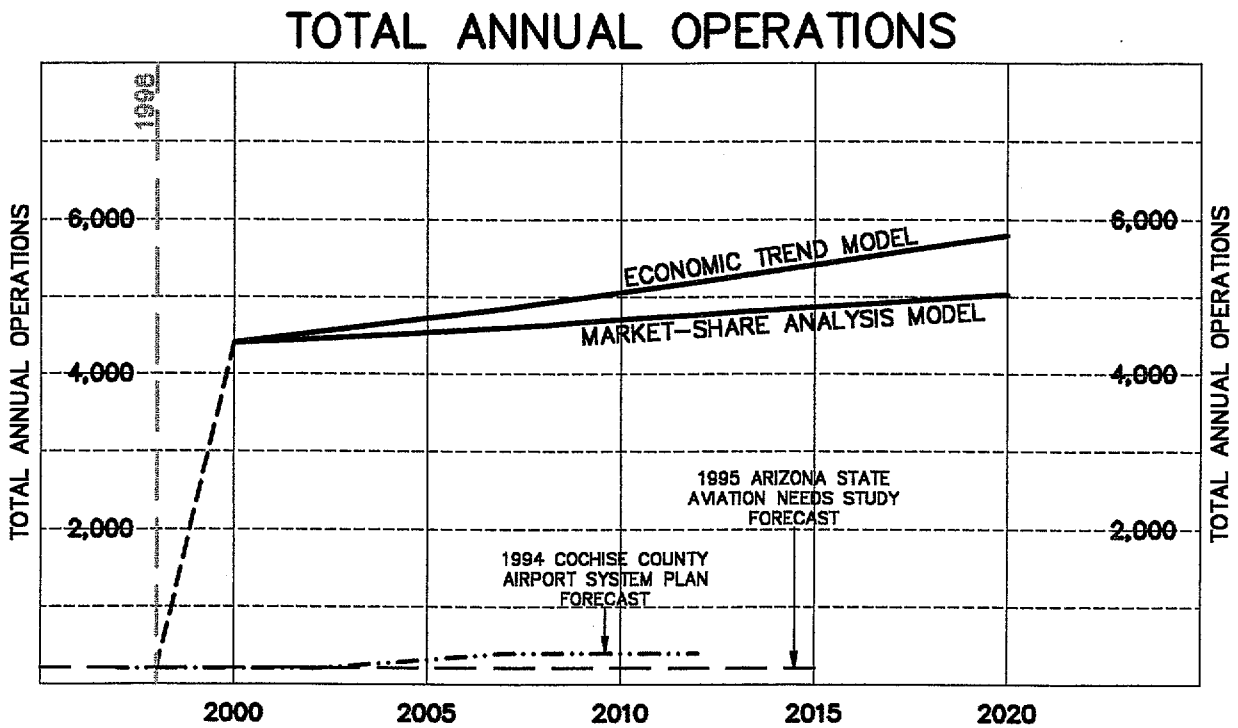
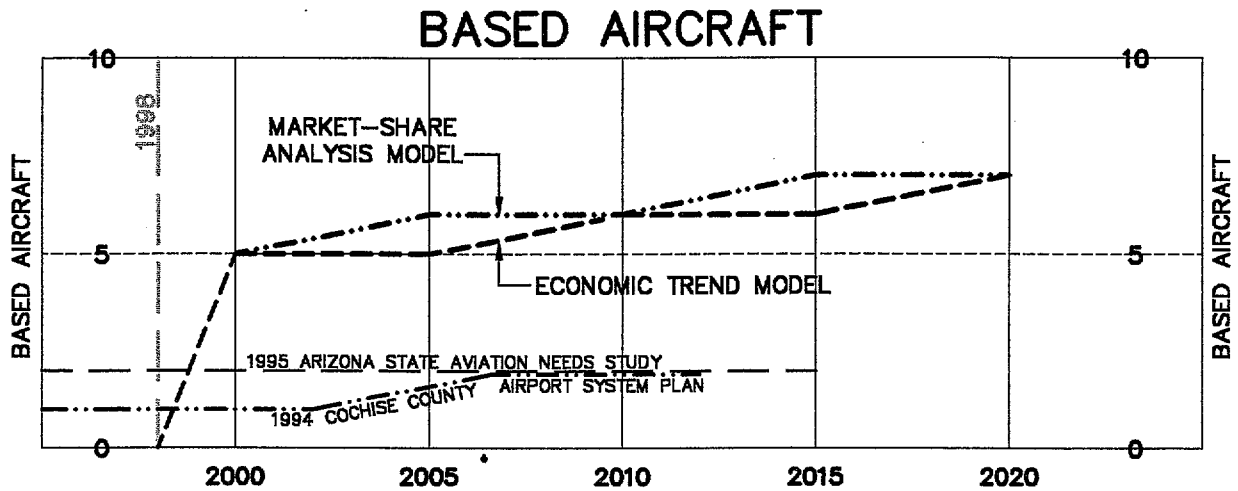


FIGURE 2A
Tombstone Municipal Airport
Tombstone, Arizona
FORECAST COMPARISON

FIGURE 2B: COMPARISON OF ACTIVITY FORECASTS FOR TOMBSTONE MUNICIPAL AIRPORT

1982 Cochise County
Airport System Plan

	<u>1981</u>	<u>1985</u>	<u>1990</u>
Based Aircraft	1	7	8
Total Operations	2,361	1,865	2,102

1994 Cochise County
Airport System Plan

	<u>1992</u>	<u>1997</u>	<u>2002</u>	<u>2007</u>	<u>2012</u>
Based Aircraft	1	1	1	2	2
Total Operations	200	200	200	400	400

1995 Arizona State
Aviation Needs Study

	<u>1995</u>	<u>2000</u>	<u>2005</u>	<u>2010</u>	<u>2015</u>
Based Aircraft	2	2	2	2	2
Total Operations	216	216	216	216	216

1998 Tombstone Airport
Master Plan -
Market Share Analysis Model

	<u>1998</u>	<u>2000</u>	<u>2005</u>	<u>2010</u>	<u>2015</u>	<u>2020</u>
Based Aircraft	0	5	6	6	7	7
Total Operations	200	4,401	4,514	4,714	4,861	5,031

1998 Tombstone Airport
Master Plan -
Economic Trend Model

	<u>1998</u>	<u>2000</u>	<u>2005</u>	<u>2010</u>	<u>2015</u>	<u>2020</u>
Based Aircraft	0	5	5	6	6	7
Total Operations	200	4,401	4,714	5,049	5,409	5,794